Final Report

Special Haul Programs
Safety Review

Presented to:

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EXECUTIVE SUMMARY

Study Objective

Trialpha Consulting Limited was retained by Saskatchewan Highways and Transportation in January 2000 to undertake the *Special Haul Programs Safety Review*. The Special Haul Programs facilitate the transport of goods on provincial highways using trucks that exceed standard size or weight limits. The objective of this study was to assess the current level of safety of the Special Haul Programs in relation to the normal truck fleet. In addition, the study served to initiate a process to allow for the on-going monitoring of safety of the program.

Program Operation

Approximately 720 trucks were issued Special Haul Program permits in 1999. The number of trucks operating in Special Haul Programs has fluctuated in the past based on the economy and business activity but the number has generally remained constant over time.

Assessment of Safety - Collision Rate Method

Normal Fleet Collision Rate

The collision rate for the normal fleet was determined to be **0.74 collisions per million vehicle-kilometres** of travel. This reflects a total of 1258 collisions being reported to police during 1999 involving all trucks over 4,500 kg. This group of trucks, commonly referred to as "heavies", is representative of all larger trucks on the roadway, including straight and articulated trucks.

The amount of truck travel generated by trucks in 1999 was based upon an estimate from 1997 for area-wide transportation planning studies being undertaken in the province. It is estimated that, in 1997, trucks in Saskatchewan generated a total of 1.64 billion vehicle-kilometres. An estimate of 1.71 billion vehicle-kilometres of truck travel for 1999 was developed by applying a growth rate of 2% per annum.

Special Haul Programs Collision Rate

The procedure for determining the number of truck collisions in Special Haul Programs included reviewing Special Haul Programs permit records, as well as a cross-referencing exercise with the SGI collision database.

The analysis found that a total of 7 collisions occurred in 1999 involving a truck operating in Special Haul Programs at the time of collision.

The amount of travel by trucks in Special Haul Programs was established by compiling truck travel records from participating companies. All companies participating in the Special Haul Programs were contacted and asked to provide information on the number of vehicle-kilometres travelled in Saskatchewan for trucks operating under the Special Haul Programs. This process yielded an estimate that approximately 47 million vehicle-kilometres were travelled by trucks in Special Haul Programs during 1999.

Based upon the number of recorded collisions and estimated travel, the collision rate for the Special Haul Programs fleet was determined at **0.15 collisions per million vehicle-kilometres**. Trucks in Special Haul Programs in 1999 accounted for 4 percent of the provincial truck fleet yet less than 1 percent of all large truck collisions in the province during 1999. The collision rate for the Special Haul Programs fleet was approximately one-fifth that of the provincial total when taking into account the estimated number of vehicle-kilometres travelled by each group.

It should be understood that this analysis is a reflection of one year of data. The collision rate for Special Haul Programs will fluctuate yearly due to the limited number of vehicles operating. The provincial collision rate remains relatively constant. More data acquired over a longer period of time (e.g. minimum 5 years) is recommended to both monitor safety over time and provide increased statistical accuracy in the established level of safety.

A review of the collisions indicates that in none of the cases was the truck size or weight the cause of the collision. Further review of the data provides the following findings:

- *three of the collisions were with animals* – these collisions are common in the province for all vehicle types. They reflect the availability of natural habitat for deer and moose in rural Saskatchewan and the regularity of highway crossings by animals. All three collisions occurred in the Timber program which operates in remote northern areas. These types of collisions are not attributed to the truck size or weight
- *three of the collisions were with another vehicle* – in all three instances the other driver was charged. The truck was struck by the other vehicle in each case. None of these collisions are attributed to the truck size or weight
- *one of the collisions was a single vehicle accident* – the roll-over was attributed to the operator falling asleep and driving off the road. This collision brings in to question the issue of allowable operating time and is not related to the truck size or weight
- *six of the seven collisions occurred in remote northern areas* – the only collision to occur south of Prince Albert was the Highway 11 Bulk Haul collision. The driver of the car was found at fault for failing to stop while approaching the highway.

Assessment of Safety - Exposure Reduction Method

During the past year trucks in Special Haul Programs generated a total of approximately 47 million vehicle-kilometres. This represents an estimated reduction in travel of approximately 24 million vehicle-kilometres (i.e. 71M-47M) compared to the scenario if Special Haul Programs were not in operation. This represents a one-third reduction in the amount of truck travel that would otherwise be required to haul the same amount product.

It was further estimated that Special Haul Programs could result in the reduction of approximately 18 truck collisions annually in the province. Total savings in the cost of these collisions is estimated at $1.2 million annually assuming typical collision costs for fatality, injury and property-damage-only collisions.

Recommendations

Recommendations for Program Operation

1. Continue the permitting process and enforcement policies to ensure that trucks operate within the standards of the Special Haul Programs. Specifically, the permitting process should be utilised to ensure proper adherence in the following areas:

    - Driver training and experience
    - Truck and trailer standards
    - Operating requirements and time restrictions
    - Truck travel and collision reporting

2. Continue the requirement that drivers must have increased experience and training to operate in Special Haul Programs. Both experience and training are commonly identified in safety studies as affecting collision rates.

3. Monitor the frequency of vehicle inspections. Inspections currently occur annually. Over time, there may be a need to increase inspections as trucking equipment used in the program, which is still relatively new, begins to age. On-going monitoring of program safety will determine if the inspection schedule needs to be stepped-up.

4. Enforce the requirement that companies operating in Special Haul Programs submit a detailed report when a collision occurs. The data can augment the information found on police reports and identify more minor collisions that might not have been reported to police.

5. Use placards to identify Special Haul Programs vehicles. Markings would provide motorists with an indication of those trucks with increased length or width, and could be used to identify Special Haul Programs vehicles within police reports. Note that this would require the co-operation of police and require a special place for annotation on police reports.

Recommendations for Future Monitoring of Safety

The following recommendations apply for future monitoring of safety of Special Haul Programs:

1. Select an appropriate safety assessment method, specifically:

    a. *Collision Rate Analysis* should be used as the primary method for assessing truck safety in the Special Haul Programs. It is preferred to apply this method to 5 or more years of historical collision data to increase accuracy of the collision rate.

    b. *Exposure Reduction Analysis* should be used as a supporting method for assessing safety in the Special Haul Programs. It is inherent that there will always be a savings in vehicle-kilometres travelled by using over-sized

or over-weight vehicles to carry the same volume of product in comparison to standard size and weight trucks. However, this analysis is still valuable for estimating annual collision cost-savings related to the Special Haul Programs.

c. *Truck Performance Characteristics Analysis* is not preferred for use in assessing safety in the Special Haul Programs. Acquiring enough information to correlate truck performance to truck collisions would require a significant amount time considering the relatively small number of collisions that currently occur on an annual basis in the Special Haul Programs.

2. Establish an accurate, detailed and maintainable database of operating and collision information regarding Special Haul Programs in order to draw comparisons to the normal fleet.

3. Include the following information in the Special Haul Programs database:

   - ***permit information*** (i.e. permit number, validation period and times, allowable truck configurations and weights, licenses of permitted trucks)

   - ***operating information*** (i.e. annual vehicle-kilometres generated by company. Travel data should be illustrated for each *configuration* of truck operated by each EEMV Program company and *permit weight* of trucks operated by companies in either the Bulk Haul or Timber Programs)

   - ***collision information*** (i.e. provincial truck collision data from SGI and truck collision reports provided by companies in Special Haul Programs. These data will establish collisions related specifically to Special Haul Programs and provide detailed information on each collision occurrence.)

4. Use the database to establish truck collision rates, exposure reduction rates and any cost-savings related to the use of over-sized or over-weight trucks. The database would also prove useful for establishing conversion factors to estimate potential vehicle-kilometres saved through the operation of Special Haul Programs.

5. Collect enough data over time to be able to relate collision rates to different truck characteristics. Collision rates could be stratified by the following categories:

   - truck configuration (e.g. double trailer, triple trailer)
   - truck size (length)
   - permitted truck weight
   - trailer connection type (i.e. A,B or C dollies)
   - roadway type (i.e. primary highway, secondary highway)

   It should be noted that this is a long-term initiative that will require many years of data in order to provide statistical accuracy in the stratified rates.

1.0 INTRODUCTION

Trialpha Consulting Limited was retained by Saskatchewan Highways and Transportation in January 2000 to undertake the *Special Haul Programs Safety Review*. The Special Haul Programs facilitate the transport of goods on provincial highways using trucks that exceed standard size or weight limits. This study was commissioned to examine the current level of safety of the Special Haul Programs.

The study process included the following activities:

- *Undertaking a Literature Review* - available literature on truck safety was reviewed to gain insight into the operation of large trucks and for applicability of this information to Saskatchewan
- *Reviewing Truck Safety* – collision records were used to establish a collision rate for the Special Haul Programs and the normal truck fleet in Saskatchewan
- *Examining Truck Exposure Rates* – the impact of using larger vehicles to reduce public exposure to the number of trucks on the road was examined
- *Developing a Safety Monitoring Protocol* – a methodology for the on-going assessment of safety in Special Haul Programs was developed

The objective of this study was to assess the current level of safety of the Special Haul Programs in relation to the normal truck fleet. In addition, the study served to initiate a process to allow for the on-going monitoring of safety of the program.

2.0 BACKGROUND TO TRUCK SIZE AND WEIGHT ISSUES

Trucking policy and regulations in Saskatchewan have evolved in response to changes in trucking technology, roadway design, understanding of safety and the economy. The use of over-sized and over-weight trucks in this province has occurred in response to the following factors:

- *Research into Truck and Pavement Performance* – changes to the size and weight of trucks has resulted from growing knowledge of a truck's handling and stability characteristics (i.e. truck performance), as well as a better understanding of the impact that different truck sizes and weights have on the pavement structure.

- *Changes to National Guidelines on Truck Sizes and Weights* – guidelines established in 1988 by the Transportation Association of Canada have resulted in standard truck size and weight limits for the most common configurations in Canada. The guidelines have resulted in western provinces (British Columbia, Alberta, Saskatchewan and Manitoba) increasing truck size and weight limits to meet the new criteria. Whereas, in the eastern provinces (i.e. Ontario eastward), typically the size and weight limits were already equal to or higher than the newly established limits. The guidelines now allow for uninterrupted inter-provincial travel within the set limits.

- *Ability to Increase Productivity* - industries are able to increase productivity through the use of trucks that can carry larger volumes or greater weights. This results in fewer trips required to move the same amount of product.

- *Need to Move Oversized Loads* - some goods can only be moved by trucks that are larger than allowed by provincial regulations. These "non-divisible" loads include products such as construction equipment, mining equipment and culvert pipe.

Considerations for allowing the over-sized or over-weight vehicles to operate on the road system are presented in Appendix A.

The issue of truck safety was further examined during this study through a literature review. The review examines the results of studies and literature from across North America on truck safety. The findings of this review are presented in Appendix B.

3.0 SPECIAL HAUL PROGRAMS OPERATION

3.1 Standard Provincial Truck Sizes and Weights

All vehicles in Saskatchewan operate under provincial size and weight regulations. Table 1 presents standard vehicle lengths for Saskatchewan.

Table 1
Standard Saskatchewan Vehicle Lengths

Vehicle Type	Maximum Length
Truck or Single Vehicle	12.5 metres
Semi-trailer Unit	23 metres
Double-trailer (A, B, C Train)	25 metres

Standard legal gross vehicle weights in Saskatchewan are enforced to the following limits:

- up to 62,500 kg on primary highways
- up to 54,500 kg on secondary highways

Primary highways are generally allowed primary weights throughout the year. A smaller group reverts to secondary weight levels during May and June when the highways are in their weakest conditions. Secondary highways are restricted to secondary weights except for a period from December through February. During these times, winter conditions allow weights to be increased. However, the maximum weight of 54,500 kg still applies. A map illustrating the primary and secondary highways, for weight enforcement purposes, is presented in Appendix C.

3.2 Special Haul Programs Description

The majority of trucks beyond standard size and weight regulations are operating in the province under the provisions of the Special Haul Programs.

Special Haul Programs provide a mechanism for moving goods efficiently. The program is used in the following two circumstances:

1. hauling a larger volume by using trailer lengths that are longer than standard
2. hauling a greater weight than allowed in the regulations

The following examples describe how trucks operating in Special Haul Programs are currently being used in Saskatchewan:

- transport of grain to value-added processing facilities (e.g. seed processors and feedlots)
- transport of raw resources (e.g. timber, potash, uranium, petroleum) generally from remote areas to processing facilities
- movement of low-density consumer goods (e.g. appliances and grocery products) in over-sized containers

A broad range of companies participate in the Special Haul Programs, representing both commercial and private carriers. Private carriers represent companies that operate their own fleet of trucks to transport goods they produce or sell (e.g. Safeway, Sears Long Haul - *SLH*, Saskatchewan Wheat Pool, Federated Co-op). Commercial carriers that are paid to transport the goods of others (e.g. NRT, Kindersley Transport, Freight Flo and Exalta) also participate in the Special Haul Programs. Some of the goods hauled include grain, minerals, petroleum, timber, wood chips, agricultural products, dry goods and groceries.

There are four programs operating within Special Haul Programs, including:

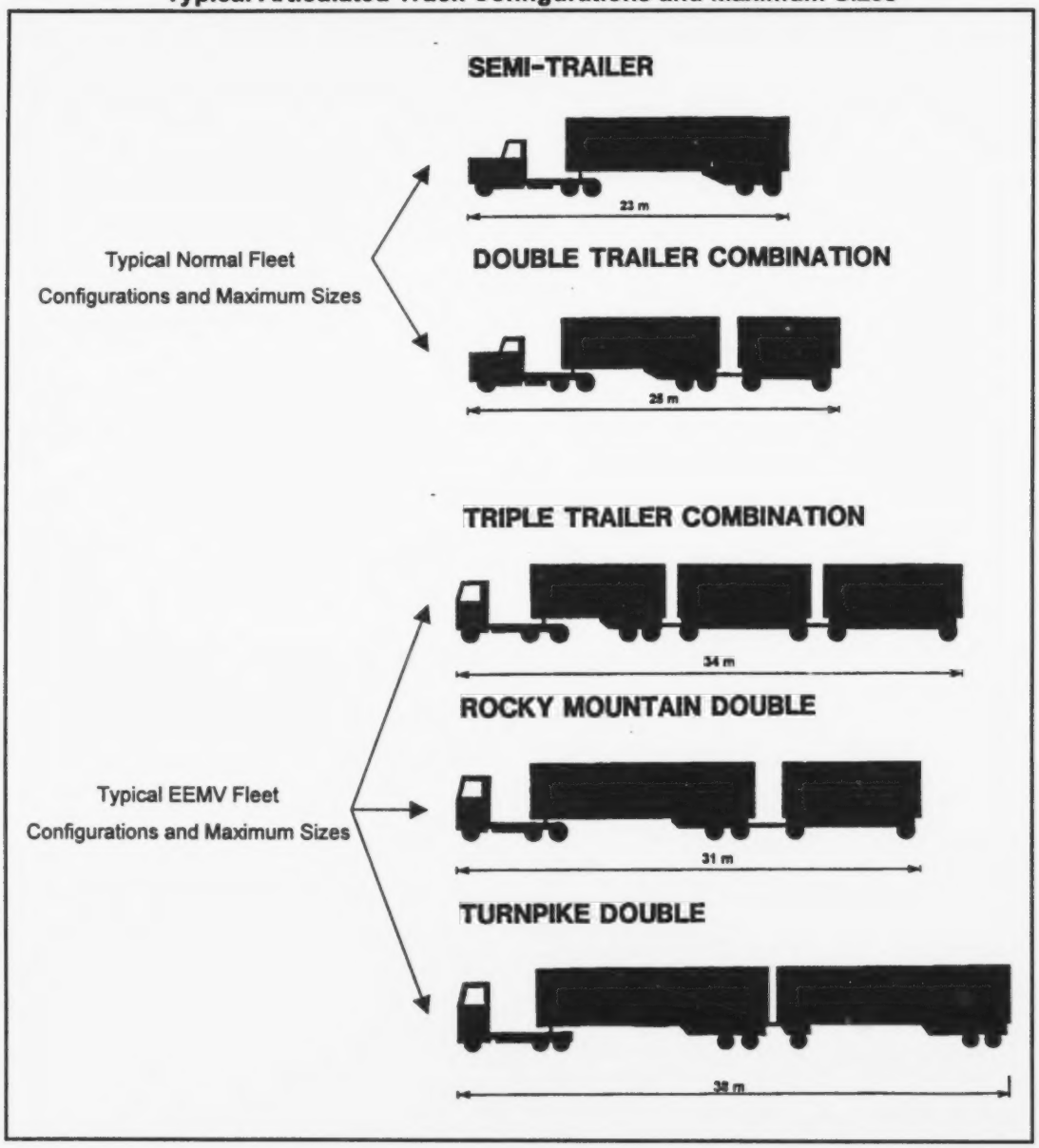
1. Bulk Haul Program
2. Energy Efficient Motor Vehicle (EEMV) Program
3. Timber Haul Program
4. Partnership Program

The operation of each program can be described as follows:

Bulk Haul Program – governed primarily by the weight of the commodities rather than the volume being hauled. Commonly the mineral, petroleum and agricultural resource industries use the Bulk Haul program. Most trucks in this program are double-trailers. Grain, sulphur, propane, ammonium sulphate and lime are some of the products transported.

Energy Efficient Motor Vehicle (EEMV) Program – governed primarily by the volume of the commodities being hauled rather than the weight. Vehicles in the EEMV program are generally used to carry low-density goods such as groceries, appliances and furniture. All vehicles in the program are considered long-combination vehicles, specifically Rocky Mountain Doubles, Turnpike Doubles or Triple-trailers. Exhibit 1 illustrates typical configurations and maximum sizes for the normal and EEMV fleet.

Exhibit 1
Typical Articulated Truck Configurations and Maximum Sizes



Rocky Mountain Doubles and Turnpike Doubles generate the majority of vehicle-kilometres in the EEMV program. Turnpike Doubles and Triple-trailers are restricted to 4-lane divided highways in the province. As such, they only operate on 3 routes, including Regina to Saskatoon; Regina to Indian Head; and Regina to Swift Current.

Timber Haul Program – governed by both weight and volume of the commodities being hauled. This program is utilised by pulp and timber companies located in the northern part of the province to transport timber and wood chips. Semi-trailers and double-trailers are commonly employed in this program. The majority of permits are granted during winter months to provide incentives for companies to haul the forest products during the period when the ground is frozen and pavement damage is minimised.

Transportation Partnership Program – partnerships to increase productivity where the weight and/or volume of the commodities hauled exceed regulations. Since 1994, the majority of Special Haul Program agreements have been implemented in the form of partnerships. The savings generated as a result of the increased productivity are shared equally between the province and the company. The funds are then reinvested in roadway infrastructure.

There are additional operating requirements (routing, vehicle inspection, driver training) for trucks in the Special Haul Programs beyond that required of the normal fleet. These additional requirements are described in Appendix D. Examples of designated travel routes for the EEMV, Bulk and Timber Programs are presented in Appendix E.

3.3 Participation

Table 2 indicates existing 1999 participation in the Special Haul Programs and typical vehicle characteristics. For reporting purposes, the summaries are identified within the three categories of Bulk Haul, EEMV and Timber.

Table 2
Special Haul Programs Characteristics

Program	Trucks	Typical Gross Vehicle Weight (tonnes)	Trailers	Typical Length (m)	Goods Transported
Bulk Haul	141	62.5 – 72.5	2	25 – 31	• minerals • petroleum • agricultural products
EEMV	303	n/a [1]	2 – 3	29 – 38	• dry goods • appliances
Timber	275 [2]	62.5 – 72.5	1 – 2	23 – 25	• raw wood products

1. Not applicable as weights do not exceed provincial regulations
2. Estimated from 545 permits. Permit conditions vary between mills, so trucks may be required to carry more than one permit.

Approximately 720 trucks were issued Special Haul Program permits in 1999. The number of trucks operating in Special Haul Programs has fluctuated in the past based on the economy and business activity but the number has generally remained constant overtime. Factors that could affect the potential size of this program are discussed in Appendix F.

4.0 ASSESSMENT OF TRUCK SAFETY

The following three methods can be applied for assessing truck safety:

1. *collision rate* method - an examination of the number of collisions per million vehicle-kilometres distance travelled. This is the most common method applied for assessing safety.

2. *exposure reduction* method - an examination of the exposure of the public to trucks as a result of using different truck sizes.

3. *performance characteristics* method - an examination of the correlation of truck performance (i.e. rollover, off-tracking and braking characteristics) to collisions.

The *collision rate* and *exposure reduction* methods were used to assess truck safety of the Special Haul Programs. A detailed assessment using the *performance characteristics* method was deemed outside the scope of this study. Currently, there is insufficient data recorded by police at an accident to be able to accurately correlate truck performance characteristics to historical truck collisions in this province. An overview of the typical truck performance characteristics is presented in Appendix G.

4.1 Collision Rate Analysis

The collision rate represents the average number of collisions that have occurred over the given distance travelled by a vehicle. Collision rates are typically presented in the form of collisions per million vehicle-kilometres of travel.

Collision rate analysis provides a valid means by which the safety of vehicle operation can be compared. Special Haul Programs trucks and normal fleet trucks operate on the same provincial network and under the same operating conditions (i.e. weather, road surface, traffic mix). As such, it was assumed that a comparison of collision rates would be valid.

The analysis was limited to an assessment of 1999 collision and truck travel data. Permit data for trucks operating in Special Haul Programs was only available for this time (i.e. the most current full-year of operation).

The assessment was conducted using a traffic collision database maintained by SGI. The Traffic Accident Information System (TAIS) database provides information on all collisions reported to police and was used to isolate those collisions in the province that involved trucks. A sample of typical collision information recorded in the database is presented in Table 3.

A single collision record will commonly have in excess of 100 elements of information describing factors surrounding the collision. The database includes information on collision time, date, location, injuries, lighting conditions, road conditions, weather conditions, driver information, pre-collision driver actions and types of vehicles involved.

Table 3
Typical Truck Collision Information - SGI Traffic Accident Database

CASE NO.	ACCDATE	ACCTIME	SEVERITY	NO. VEH	NO. INJ	NO. KILLED	COMMNAME	ROADAUTH	CTRLSECT	ATKM	RM	SIDEOF	NATLIGHT	ARTLIGHT	WEATHER	ROADSURF	ROADCOND	ACCSITE	CONFIG
799814	05-Dec-99	2345	2	1	1	0	CHAPLIN	03	0011900	7.5			2	1	1	1	1	01	04
793323	05-Jan-99	1130	2	2	1	0	SHELLBROOK	03	2400100	31.1			1	1	2	1	1	03	09
800243	14-Mar-99	2200	2	1	1	0	WOLSELEY	03	0010500	0			2	1	7	4	1	01	01
800247	12-Aug-99	50	1	1	0	0	SUMMERBERRY	03	0010500	2			2		1	1	1	01	16
801848	04-Apr-99	830	1	2	0	0	RADISSON	03	0162400	12.6			1	1	4	3	1	01	09
801850	06-May-99	1830	1	2	0	0	MAYMONT	03	0162500	24.7				1	1	1	1	02	13
802372	23-Mar-99	430	2	1	1	0	PRAIRIE RIVER	03	0030400	4.9			2	1	1	1	1	01	01
810517	24-Sep-99	1130	1	2	0	0	CUMBERLAND HOUSE	03	1230200	30				1	2	1	3	05	05
813513	09-Jun-99	1115	1	2	0	0	RAYMORE	03	0090800	54.1			1	2	2	1	1	02	06
822968	05-Feb-99	1715	1	1	0	0	CARLYLE	09		0			1	1	1	4	4	01	16
823823	26-Jan-99	1615	1	2	0	0	MOOSE JAW	03	0011300	8.6			1	1	1	4	1	01	09
823824	26-Jan-99	1910	2	2	1	0	MORTLACH	03	0011300	40.7			2	1	1	4	1	01	09
824461	31-May-99	1800	2	2	1	0	LESTOCK	06		0	247	S	1	1	1	5	1	03	05
831348	29-May-99	1030	2	2	1	0	TADMORE	07		0	304	N	1	1	1	5	1	01	05
843994	16-Nov-99	400	1	1	0	0	WASKESIU LAKE	03	0022200	3			1	1	1	1	1	01	16
845598	15-Jun-99	1945	1	1	0	0	INDIAN HEAD	06		0	156	W	1	1	1	1	1	01	04
848844	15-Jun-99	1015	2	1	1	0	WAKAW	03	0021700	3.5			1	1	1	1	1	01	04
848872	15-Feb-99	1650	1	1	0	0	ALVENA	06		0	402	N	1	1	1	1	1	03	16
849710	26-Jun-99	1145	2	2	2	0	WAKAW	03	0410300	0.1			1	1	1	1	1	02	09
850318	25-Jul-99	1845	1	2	0	0	CHAPLIN	03	0011500	9			1	1	1	1	1	01	09
852748	07-May-99	1500	1	2	0	0	LLOYDMINSTER	01		0			1	1	1	1	1	01	09
856316	04-Jul-99	1800	1	2	0	0	BALGONIE	03	0010800	1.7			1	1	1	1	1	11	09
856726	23-Aug-99	1335	1	2	0	0	KELVINGTON	07		0	368	E	1	1	1	1	1	01	05
874340	12-Aug-99	1900	2	2	1	0	HANLEY	03	0110600	31			1	1	1	1	1	01	05
878444	30-Jul-99	1900	1	2	0	0	KYLE	03	0020800	36			1	1	1	1	1	01	07
879880	28-Jan-99	1630	1	1	0	0	CORINNE	03	0080800	44.3				1	7	4	1	01	04
885383	29-Apr-99	915	2	1	1	0	WOODSTON [illegible]	04	0080300	7.5				1	4	4	1	01	03
885843	12-Oct-99	2345	1	2	0	0	[illegible]W GROVE	03	0340800	60.8			2	1	8	1	1	01	05
905875	05-Aug-99	1700	1	1	0	0	SCOTT	03	0740100	58.2			1	1	1	1	2	03	16
906733	10-Sep-99	1240	1	1	0	0	SCOTT	07		0	321	S	1	1	1	1	1	07	01
907810	18-Mar-99	2200	1	2	0	0	[illegible]PELLA	03	0010200	15			2	1	1	1	1	01	01
915169	12-Jan-99	0	2	2	0	0	[illegible]HARD	03	0400300	23.6			4	1	1	3	1	01	05
918312	10-Feb-99	1030	2	2	2	0	SOUTHEY	03	0080700	7.5			1		7	4	1	06	05
923080	23-Aug-99	1630	2	2	4	0	GLENBUSH	06		0	467	N	2	1	1	1	1	05	14
924695	02-Sep-99	1900	1	1	0	0	LOON LAKE	07		0	561	E	1	1	1	8	2	01	04
944888	29-Jul-99	1230	1	1	0	0	STOCKHOLM	06		0	163	S	1	1	7	5	1	03	05
951736	26-May-99	645	2	2	1	0	DEBDEN	03	0551000	42.3			1	1	2	1	1	02	09
953120	16-Feb-99	1000	2	2	1	0	LA LOCHE	03	1550300	66			1	1	4	3	2	01	05
957419	29-May-99	910	1	2	0	0	SASKATOON	01		0			1	2	1	1	1	01	05
974822	09-Dec-99	1545	1	2	0	0	ESTEVAN	01		0			1	1	1	1	1	04	15
979816	23-Feb-99	1730	1	1	0	0	CORINNE	03	0080400	1			1	1	4	4	1	01	16
979821	22-Nov-99	1653	1	1	0	0	ESTUN	03	3080200	21.5			1	1	8	4	1	03	04
979367	03-Jan-99	1700	2	2	1	0	SASKATOON	03	0110800	29			1	1	1	4	1	03	06
985720	18-Dec-99	450	2	1	1	0	TOMPKINS	03	0012000	27.6			1	1	3	2	1	01	04
986241	06-Jan-99	2305	1	2	0	0	DAVIDSON	03	0110500	41.3			1	3	1	1	1	04	06
986242	10-Feb-99	1345	1	2	0	0	CHAMBERLAIN	03	0110400	12.1			1	1	7	4	1	04	06
986586	11-Dec-99	2250	1	1	0	0	HERBERT	03	0011600	15.3			1	1	1	1	1	01	02
986619	01-Aug-99	700	1	1	0	0	MORSE	03	0011600	8.9			1	1	1	1	1	01	04
986620	05-Oct-99	1335	2	1	1	0	HERBERT	03	0011600	14.6			1	1	1	1	1	01	04
986621	11-Oct-99	1054	2	1	1	0	ERNFOLD	03	0011500	20			1	1	1	1	1	01	04
986673	03-May-99	45	2	2	1	0	MAPLE CREEK	03	0012200	21.8			2	1	1	1	1	01	04
986674	03-May-99	230	1	1	0	0	MAPLE CREEK	03	0012200	28			2		1	1	1	01	01

Sample

Normal Fleet Collision Rate

The collision rate for the normal fleet was determined to be 0.74 collisions per million vehicle-kilometres of travel. This reflects a total of 1258 collisions being reported to police during 1999 involving all trucks over 4,500 kg. This group of trucks, commonly referred to as "heavies", is representative of all larger trucks on the roadway, including straight and articulated trucks.

The amount of truck travel generated by trucks in 1999 was based upon an estimate from 1997 for area-wide transportation planning studies being undertaken in the province. It is estimated that, in 1997, trucks in Saskatchewan generated a total of 1.64 billion vehicle-kilometres. An estimate of 1.71 billion vehicle-kilometres of truck travel for 1999 was developed by applying a growth rate of 2% per annum.

Special Haul Programs Collision Rate

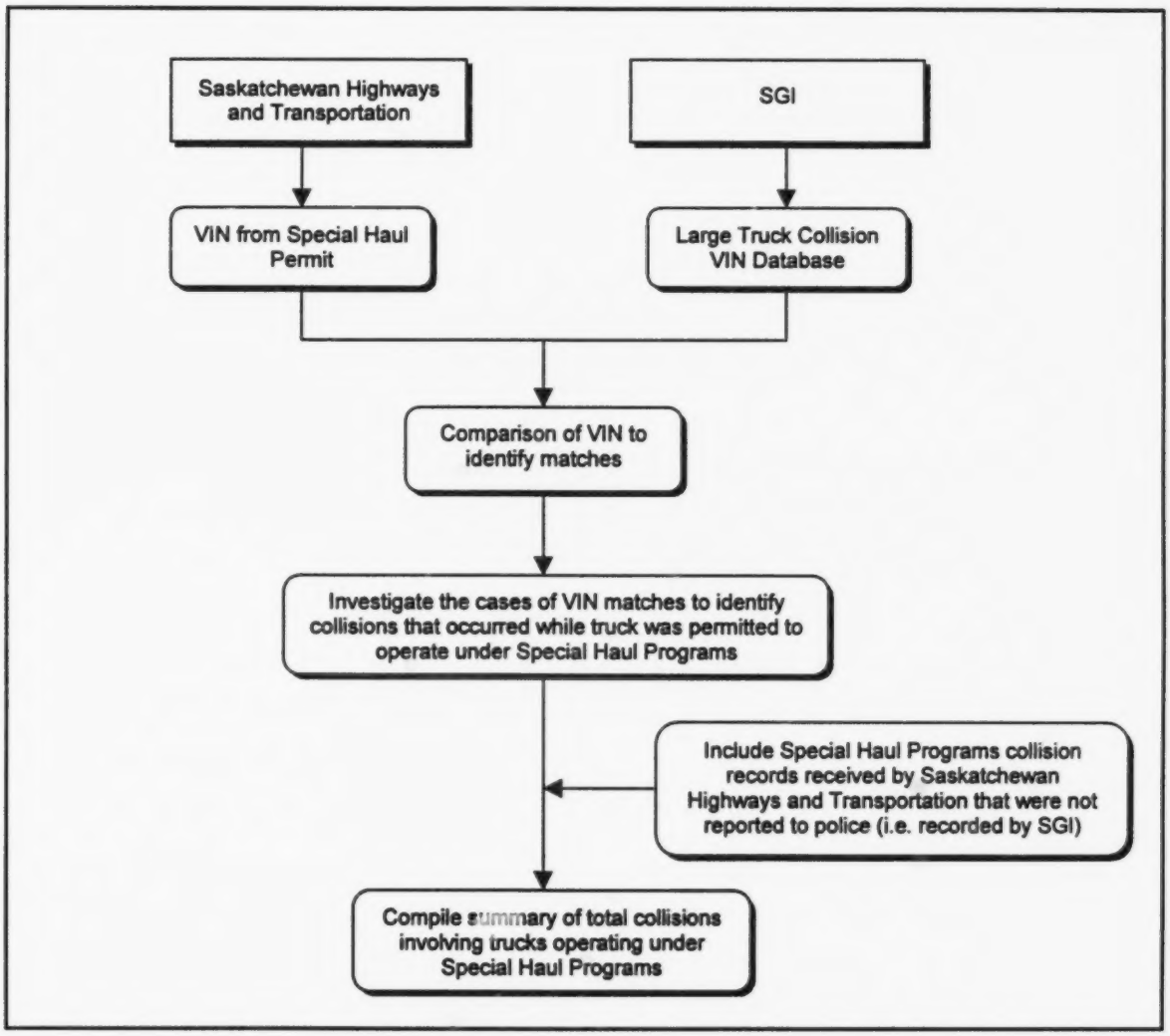
The procedure for determining the number of truck collisions in Special Haul Programs included reviewing Special Haul Programs permit records, as well as a cross-referencing exercise with the SGI collision database.

The following represents a detailed description of the procedure applied to identify collisions in Special Haul Programs:

1. The database of all truck collisions occurring in Saskatchewan in 1999 was obtained from SGI. This database represented all collisions involving trucks in both the normal fleet and Special Haul Programs that were reported to the police.
2. All of the permits issued under Special Haul Programs was collected and added to a database. The permits identified all the trucks that operated under the provisions of the Special Haul Programs in 1999.
3. The license plate numbers (i.e. vehicle identification number) of trucks involved in collisions from the SGI database were compared to the license plate numbers on permits issued under Special Haul Programs. The matches identified between the two databases represented all police-reported collisions that have involved a truck operating in the Special Haul Programs, whether or not the truck was operating under the provisions of the Special Haul Programs at the time of the collision. It was then necessary to investigate all the matches found through the database comparison to determine if the collision occurred while the truck was operating under Special Haul Programs at the time of the collision.
4. Any additional Special Haul Programs collision records received by Saskatchewan Highways and Transportation that had not been recorded by SGI (e.g. minor collisions not requiring police presence) were then added to the total number of Special Haul Programs collisions.

Exhibit 2 illustrates a flowchart of this procedure.

Exhibit 2
Special Haul Programs Collision Identification Procedure


Saskatchewan Highways and Transportation
SGI
VIN from Special Haul Permit
Large Truck Collision VIN Database
Comparison of VIN to identify matches
Investigate the cases of VIN matches to identify collisions that occurred while truck was permitted to operate under Special Haul Programs
Include Special Haul Programs collision records received by Saskatchewan Highways and Transportation that were not reported to police (i.e. recorded by SGI)
Compile summary of total collisions involving trucks operating under Special Haul Programs

The analysis revealed that 7 collisions occurred in 1999 involving a truck operating in Special Haul Programs at the time of collision.

The amount of travel by trucks in Special Haul Programs was then established by compiling truck travel records from participating companies. All companies participating in the Special Haul Programs were contacted and asked to provide information on the number of vehicle-kilometres travelled in Saskatchewan for trucks operating under the Special Haul Programs. This process yielded an estimate of approximately 47 million vehicle-kilometres travelled by trucks in Special Haul Programs during 1999.

Based upon the number of recorded collisions and estimated travel, the collision rate for the Special Haul Programs fleet was determined at 0.15 collisions per million vehicle-kilometres. A summary of the amount of travel, collision information and fleet size data for Special Haul Programs trucks and the normal fleet is presented in Table 4.

Table 4
1999 Truck Collisions

	Special Haul #	Special Haul (% of Province)	Saskatchewan [1]
Estimated Fleet Size	719	(4.0 %)	18,521
Collisions	7	(0.6 %)	1,258
Estimated Vehicle-Kilometres Travelled (millions)	47	(3.0 %)	1,710
Collision Rate (per million vehicle-kilometres)	0.15	(20.0 %)	0.74

[1] data reflects all trucks > 4,500 kg in the province

Trucks in Special Haul Programs in 1999 accounted for 4 percent of the provincial truck fleet yet less than 1 percent of all large truck collisions in the province during 1999. The collision rate for the Special Haul Programs fleet was approximately one-fifth that of the provincial total when taking into account the estimated number of vehicle-kilometres travelled by each group.

Various collision rates have been developed in the past for Saskatchewan, ranging from 0.71 to 0.95 collisions per million vehicle-kilometres (coll/mvkm). The current rate used in this study is in keeping with historical rates.

It should be understood that this analysis is a reflection of one year of data. The collision rate for Special Haul Programs will fluctuate yearly due to the limited number of vehicles operating. The provincial collision rate remains relatively constant. More data acquired over a longer period of time (e.g. minimum 5 years) is recommended to both monitor safety over time and provide increased statistical accuracy in the established level of safety.

A summary of the collisions involving trucks operating in Special Haul Programs during 1999 is presented in Table 5.

Table 5
1999 Special Haul Programs Collision Description

Case No.	Location – Nearest Community	Program	Collision Type	Injuries	Fatalities	Explanation
1219924	Hwy 120 – Candle Lake	Timber	animal	0	0	Truck hit moose.
1195377	Hwy 55 – Big River	Timber	animal	0	0	Truck hit deer.
1168300	Hwy 922 – Big River	Timber	animal	0	0	Truck hit deer.
1092520	Hwy 11 – Hague	Bulk	automobile	0	0	Car failed to stop on side-road to highway and hit truck at right angle.
951736	Hwy 55 – Debden	Timber	automobile	1	0	Truck turning left at intersection was hit by half-ton truck attempting to pass.
1151048	Hwy 4 – Dorintosh	Timber	automobile	2	0	Truck stopped on road in foggy conditions was struck by two vehicles approaching in the opposite direction.
1148473	Hwy 55 – Canwood	Timber	single vehicle	0	0	Driver fell asleep and rolled truck into ditch.

A review of the collisions indicates that in none of the cases was the truck size or weight the cause of the collision. Further review of the data provides the following findings:

- *three of the collisions were with animals* – these collisions are common in the province for all vehicle types. They reflect the availability of natural habitat for deer and moose in rural Saskatchewan and the regularity of highway crossings by animals. All three collisions occurred in the Timber program which operates in remote northern areas. These types of collisions are not attributed to the truck size or weight
- *three of the collisions were with another vehicle* – in all three instances the other driver was charged. The truck was struck by the other vehicle in each case. None of these collisions are attributed to the truck size or weight
- *one of the collisions was a single vehicle accident* – the roll-over was attributed to the operator falling asleep and driving off the road. This collision brings in to question the issue of allowable operating time and is not related to the truck size or weight
- *six of the seven collisions occurred in remote northern areas* – the only collision to occur south of Prince Albert was the Highway 11 Bulk Haul collision. The driver of the car was found at fault for failing to stop while approaching the highway.

Findings

A total of 7 large truck collisions occurred in 1999 while the truck was operating under the Special Haul Programs. Two of the collisions with an automobile involved an injury.

The collision examination indicated that the Special Haul Programs fleet has been subject to same type of collisions that the normal fleet experiences. In none of the cases could it be determined that the cause of the collision was attributed to the size or weight of the truck.

4.2 Exposure Reduction Analysis

It has been found that there is a direct relationship between the number of collisions and the amount of vehicle-kilometres travelled by trucks. Increasing truck travel increases the exposure of trucks to other motorists and consequently, the number of collisions with large trucks also increases.

The operation of oversized or overweight trucks in the Special Haul Programs allows a given amount of product to be transported with fewer trips than would be required with a truck of standard size or weight. For example, the operation of a turnpike double with two 48-foot trailers would require half the truck trips that would be generated by a standard truck with a single 48-foot trailer to move the same amount of product. It is understood that a decrease in truck trips would also result in a decrease in the number of vehicle-kilometres travelled by trucks.

It can be expected that reducing the amount of truck travel through the operation of Special Haul Program trucks will result in a decrease in collisions that might otherwise occur. Based upon the analysis in the previous section, the collision rate for Special Haul Program trucks is lower than the rate for the normal truck fleet. As such a reduction in truck travel does not result at the expense of the operation of trucks with a higher collision rate.

This study estimated the potential number of collisions that have been reduced as a result of the operation of the Special Haul Programs in 1999. Determining the reduction in collisions requires an estimation of the potential number of truck kilometres that would have been generated if the same amount of product that was transported by Special Haul Program trucks in 1999 was moved using standard truck sizes and weights. The difference between the potential kilometres travelled by trucks of standard sizes and weights and the kilometres travelled by Special Haul Program trucks represents the potential reduction in the truck travel. This difference can then be used to estimate the potential reduction in collisions.

The following protocol was used to estimate the number of vehicle-kilometres that might have been generated if the same amount of product transported by Special Haul Program trucks in 1999 was instead moved by trucks operating under standard sizes and weights:

1) *Determination of the number of vehicle-kilometres generated by trucks in Special Haul Programs in 1999* – participating companies were contacted and asked to provide the total vehicle-kilometres generated and tonnage hauled by their trucks while operating under Special Haul Programs. Due to the unavailability of travel data from previous years, only the truck travel generated in 1999 was acquired.

2) *Assessment of the amount of truck travel generated by each of the truck configurations employed by companies in Special Haul Programs* – the number of kilometres generated by truck configurations in each company was estimated.

3) *Assessment of the truck sizes or weights a company would utilise if not operating under Special Haul Programs* – EEMV, Timber and Bulk programs would each use different truck configurations or carry different weights if not operating in Special Haul Programs. For example, a company in the EEMV program operating with a typical trailer length of 96 feet might instead operate with 53-foot single trailers. A typical 9-axle truck operating in the Bulk Haul program with a payload of 52 tonnes would instead be allowed to haul a 42 tonne payload under

standard regulations. A typical 6-axle truck operating in the Timber Haul program with a payload of 44 tonnes would instead be allowed to haul a 28 tonne payload under standard regulations.

Conversion factors from Special Haul trucks to normal fleet trucks were then developed for each company operating within Special Haul Programs. Table 6 indicates the range of conversion factors used for companies in each program. These factors represent the ratio of vehicle-kilometres that could be generated if the same amount of product were moved using regulation truck sizes and weights to the number of vehicle-kilometres each company in Special Haul Programs currently generates.

Table 6
Typical Truck Conversion Factors -
Special Haul to Normal Fleet

Program	Conversion Factor
Bulk	1.2 – 2.0
EEMV	1.7
Timber	1.1 – 1.6

Note that EEMV estimates were based on the volume of goods hauled. Bulk and Timber estimates were based on the weight of the goods being hauled.

More than one conversion factor could be applied for a company depending upon the range of truck configurations operated. In the case of the EEMV program, a single conversion factor of 1.7 was established. This reflects that the capacity of regulation trucks would have 50 percent to 70 percent the capacity of trucks operating in Special Haul programs. An average conversion of 60 percent was used in the study (i.e. 1 / 0.6 = 1.7).

Tables 7 through 9 present estimated conversion factors by company participating in the Bulk Haul, EEMV and Timber programs, respectively.

Table 7
Bulk Haul Program
1999 Actual and Potential Travel

Company	Truck Configuration	Kilometres Travelled	Special Haul Pemit Weight (tonnes)	Regulation Weight (tonnes)	Truck Tare Weight (tonnes)	Special Haul Payload Weight (tonnes)	Regulation Payload Weight (tonnes)	Conversion Factor	Potential Kilometres	Potential Kilometres Savings
NRT (Northern Resource Trucking)	5-axle	1,635,500	41.5	34.5	18.0	23.5	16.5	1.42	2,329,348	693,848
	6-axle	1,635,500	46.5	40.0	18.0	28.5	22.0	1.30	2,118,716	483,216
	8-axle	3,271,000	65.5	62.5	18.0	47.5	44.5	1.07	3,491,517	220,517
	9-axle	3,271,000	72.5	62.5	18.0	n/a	n/a	2.00 [1]	6,542,000	3,271,000
Total		**9,813,000**							**14,481,581**	**4,668,581**
Federated Coop	8-axle	96688	62.5	41.5	19.1	43.4	22.4	1.94	187,333	90,645
	9-axle	1,375,793	70.5	62.5	20.3	50.2	42.2	1.19	1,636,607	260,814
	9-axle	5,243,887	72.5	62.5	20.3	52.2	42.2	1.24	6,486,514	1,242,627
	13-axle	188,552	83.5	62.5	29.8	53.7	32.7	1.64	309,640	121,088
Total		**6,904,920**							**8,620,095**	**1,715,175**
R&G Transport	9-axle	670,796	72.5	62.5	22.5	50.0	40.0	1.25	838,495	167,699
Total		**670,796**							**838,495**	**167,699**
Sask Wheat Pool	8-axle	76990	62.5	54.5	20.8	41.7	33.7	1.24	95,267	18,277
	9-axle	195,955	70.5	62.5	24.0	46.9	38.0	1.29	252,163	56,208
	9-axle	220,970	77.5	62.5	24.0	46.9	38.0	1.29	284,354	63,384
Total		**493,915**							**631,783**	**137,868**
Grand Total		**17,882,631**							**24,571,954**	**6,689,323**

[1] Based upon consultation with NRT, it was indicated that travel would potentially double if Special Haul Program provisions were not implemented.

Table 8
EEMV Program
1999 Actual and Potential Travel

Company	Actual Kilometres Travelled	Conversion Factor	Potential Kilometres Travelled	Potential Kilometre Savings
Atomic	850,000	1.67	1,419,500	569,500
Calac	3,000,000	1.67	5,010,000	2,010,000
Safeway	19,681	1.67	32,867	13,186
Canadian Freight	176,263	1.67	294,359	118,096
Coco Cola	25,000	1.67	41,750	16,750
EBD	52,000	1.67	86,840	34,840
Exalta	591,187	1.67	987,282	396,095
Freight Flo	53,894	1.67	90,003	36,109
Federated Coop	183,000	1.67	305,610	122,610
Frontier	25,000	1.67	41,750	16,750
Horton	1,066,000	1.67	1,780,220	714,220
Jay's Moving	1,000,000	1.67	1,670,000	670,000
Kindersley	2,424,139	1.67	4,048,312	1,624,173
Legal Freight	23,000	1.67	38,410	15,410
Mattjenn Enterprise	35,500	1.67	59,285	23,785
Praire Warehouse	3,000	1.67	5,010	2,010
Prudomme	389,376	1.67	650,258	260,882
Ridsdale	1,194,065	1.67	1,994,089	800,024
Rosenau	186,000	1.67	310,620	124,620
SLH	2,980,622	1.67	4,977,639	1,997,017
T&T Trucking	360,000	1.67	601,200	241,200
Transx Ltd	40,000	1.67	66,800	26,800
Grand Total	**14,677,727**		**24,511,804**	**9,834,077**

Table 9
Timber Program
1999 Actual and Potential Travel

Company	Truck Configuration	Season	Actual Kilometres Travelled	Special Haul Permit Weight (tonnes)	Regulation Weight (tonnes)	Truck Tare Weight (tonnes)	Special Haul Payload Weight (tonnes)	Regulation Payload Weight (tonnes)	Conversion Factor	Potential Kilometres Travelled	Potential Kilometres Savings
Weyerhaeuser	6-axle	Winter	3,400,000	62.5	46.5	18.0	44.5	28.5	1.56	5,306,772	1,906,772
	8-axle	Winter	1,014,000	75.0	62.5	22.0	53.0	40.5	1.31	1,326,963	312,963
	6-axle	Summer	680,000	62.5	46.5	18.0	44.5	28.5	1.56	1,061,754	381,754
	6-axle	Summer	170,000	62.5	40.0	18.0	44.5	22.0	2.02	343,864	173,864
	8-axle	Summer	676,000	73.0	54.5	23.5	49.5	31.0	1.60	1,079,419	403,419
Total			5,940,000							9,120,772	3,180,772
Clearwater	6-axle	Winter	96,960	62.5	46.5	18.0	44.5	28.5	1.56	151,394	54,434
	8-axle	Winter	187,860	75.0	62.5	23.5	51.5	39.0	1.32	248,072	60,212
	6-axle	Summer	96,960	46.5	40.0	18.0	28.5	22.0	1.30	125,607	28,647
	8-axle	Summer	187,860	62.5	54.5	23.5	39.0	31.0	1.26	236,340	48,480
	9-axle	Summer	30,300	70.5	65.0	25.5	45.0	39.5	1.14	34,519	4,219
Total			599,940							795,931	195,991
SaskFor MacMillan	6-axle	Winter	903,240	62.5	46.5	18.0	44.5	28.5	1.56	1,410,322	507,082
	7-axle	Winter	451,620	75.0	62.5	21.0	54.0	41.5	1.30	587,650	136,030
	8-axle	Winter	451,620	75.0	62.5	23.5	51.5	39.0	1.32	596,370	144,750
	6-axle	Summer	251,845	62.5	46.5	18.0	44.5	28.5	1.56	393,232	141,387
	7-axle	Summer	51,005	75.0	56.5	23.0	52.0	33.5	1.55	79,172	28,167
	8-axle	Summer	9,565	75.0	62.5	23.5	51.5	39.0	1.32	12,631	3,066
Total			2,118,895							3,079,377	960,482
Norsask	6-axle	Winter	4,822,270	62.5	46.5	18.0	44.5	28.5	1.56	7,529,509	2,707,239
	8-axle	Winter	253,800	75.0	62.5	23.5	51.5	39.0	1.32	335,146	81,346
	6-axle	Summer	1,078,665	46.5	40.0	18.0	28.5	22.0	1.30	1,397,361	318,696
Total			6,154,735							9,262,017	3,107,282
Grand Total			14,813,570							22,258,097	7,444,527

Table 10 provides a summary of the estimated reduction in collisions as a result of the lower number of vehicle-kilometres generated in 1999 from vehicles in Special Haul Programs.

Table 10
Impact of Special Haul Programs Travel on Collision Totals

	Program Travel	Comparable Normal Fleet Travel	Travel Difference	Collision Difference [1]
Bulk	17,883,000 km	24,572,000 km	27 %	5
EEMV	14,678,000 km	24,511,000 km	40 %	7
Timber	14,814,000 km	22,258,000 km	33 %	6
TOTAL	**47,375,000 km**	**71,341,000 km**	**34 %**	**18**

[1] Based on the 1999 provincial truck collision rate of 0.74 collisions per million vehicle-kilometres travelled.

During the past year trucks in Special Haul Programs generated a total of approximately 47 million vehicle-kilometres. This represents an estimated reduction in travel of approximately 24 million vehicle-kilometres (i.e. 71M-47M) compared to the scenario if Special Haul Programs were not in operation.

It was further estimated that Special Haul Programs could result in the reduction of approximately 18 truck collisions annually in the province. Total savings in the cost of these collisions is estimated at $1.2 million annually assuming typical collision costs for fatality, injury and property-damage-only collisions.

Findings

Special Haul Programs are estimated to result in a one-third reduction in the amount of truck travel that would otherwise be required to haul the same amount product. The associated collision cost savings is estimated at $1.2 million annually.

5.0 RECOMMENDATIONS

5.1 Program Operation

1. Continue the permitting process and enforcement policies to ensure that trucks operate within the standards of the Special Haul Programs. Specifically, the permitting process should be utilised to ensure proper adherence in the following areas:

    - Driver training and experience
    - Truck and trailer standards
    - Operating requirements and time restrictions
    - Truck travel and collision reporting

2. Continue the requirement that drivers must have increased experience and training to operate in Special Haul Programs. Both experience and training are commonly identified in safety studies as affecting collision rates.

3. Monitor the frequency of vehicle inspections. Inspections currently occur annually. Over time, there may be a need to increase inspections as trucking equipment used in the program, which is still relatively new, begins to age. On-going monitoring of program safety will determine if the inspection schedule needs to be stepped-up.

4. Enforce the requirement that companies operating in Special Haul Programs submit a detailed report when a collision occurs. The data can augment the information found on police reports and identify more minor collisions that might not have been reported to police.

5. Use placards to identify Special Haul Programs vehicles. Markings would provide motorists with an indication of those trucks with increased length or width, and could be used to identify Special Haul Programs vehicles within police reports. Note that this would require the co-operation of police and require a special place for annotation on police reports.

5.2 Future Monitoring of Safety

The following recommendations apply for future monitoring of safety of Special Haul Programs:

1. Select an appropriate safety assessment method, specifically:

    a. *Collision Rate Analysis* should be used as the primary method for assessing truck safety in the Special Haul Programs. It is preferred to apply this method to 5 or more years of historical collision data to increase accuracy of the collision rate.

    b. *Exposure Reduction Analysis* should be used as a supporting method for assessing safety in the Special Haul Programs. It is inherent that there will always be a savings in vehicle-kilometres travelled by using over-sized

or over-weight vehicles to carry the same volume of product in comparison to standard size and weight trucks. However, this analysis is still valuable for estimating annual collision cost-savings related to the Special Haul Programs.

c. *Truck Performance Characteristics Analysis* is not preferred for use in assessing safety in the Special Haul Programs. Acquiring enough information to correlate truck performance to truck collisions would require a significant amount time considering the relatively small number of collisions that currently occur on an annual basis in the Special Haul Programs.

2. Establish an accurate, detailed and maintainable database of operating and collision information regarding Special Haul Programs in order to draw comparisons to the normal fleet.

3. Include the following information in the Special Haul Programs database:

   - ***permit information*** (i.e. permit number, validation period and times, allowable truck configurations and weights, licenses of permitted trucks)

   - ***operating information*** (i.e. annual vehicle-kilometres generated by company. Travel data should be illustrated for each *configuration* of truck operated by each EEMV Program company and *permit weight* of trucks operated by companies in either the Bulk Haul or Timber Programs)

   - ***collision information*** (i.e. provincial truck collision data from SGI and truck collision reports provided by companies in Special Haul Programs. These data will establish collisions related specifically to Special Haul Programs and provide detailed information on each collision occurrence.)

4. Use the database to establish truck collision rates, exposure reduction rates and any cost-savings related to the use of over-sized or over-weight trucks. The database would also prove useful for establishing conversion factors to estimate potential vehicle-kilometres saved through the operation of Special Haul Programs.

5. Collect enough data over time to be able to relate collision rates to different truck characteristics. Collision rates could be stratified by the following categories:

   - truck configuration (e.g. double trailer, triple trailer)
   - truck size (length)
   - permitted truck weight
   - trailer connection type (i.e. A,B or C dollies)
   - roadway type (i.e. primary highway, secondary highway)

   It should be noted that this is a long-term initiative that will require many years of data in order to provide statistical accuracy in the stratified rates.

6.0 CONCLUSION

Based on the review of 1999 data, Special Haul Programs have a collision rate that is estimated at one-fifth that of the normal fleet in Saskatchewan. Further, an estimated 23 million vehicle-kilometres of truck travel were eliminated that might have otherwise been generated using standard size and weight trucks. This amount of travel would typically have resulted in an estimated 18 collisions involving trucks.

Literature from across North America indicates the challenges in assessing safety of trucks due to lack of data. The goal of Special Haul Programs should be to compile the necessary collision and travel data to monitor safety benefits over time and increase accuracy of collision rate estimates. The protocol recommended in this report should be applied in the future to provide on-going monitoring of safety of the Special Haul Programs.

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APPENDIX A

CONSIDERATIONS FOR ALLOWING

OVER-SIZED AND OVER-WEIGHT VEHICLES

CONSIDERATIONS FOR ALLOWING OVER-SIZED AND OVER-WEIGHT VEHICLES

There are various considerations in allowing vehicles to operate beyond the standard provincial size and weight regulations, including:

- safety - considerations that apply to the truck include braking ability, side-sway and roll-over potential. For the motorist, the main safety consideration is the ability to overtake and pass a truck, particularly longer trucks.

- normal truck weights and dimensions have been developed to reflect typical traffic mix, road design standards and truck operating characteristics that are in general practice. They are not intended as maximum standards that cannot be exceeded.

- the use of over-size or over-weight trucks can provide economic savings for industries transporting commodities over long distances. These efficiencies may allow companies to compete better, reduce the price of goods for consumers and increase the potential for companies to locate in an area.

- bridge and pavement capacities may limit options for route selection.

APPENDIX B

LITERATURE REVIEW SUMMARY

1.0 TRUCKING INDUSTRY OVERVIEW

A literature review was conducted to examine the trucking industry within North America and to determine the relevance of any findings to Saskatchewan. Such elements as fleet composition, relevant trucking legislation, trends, etc. were considered. The literature review was intended to provide an appreciation for industry changes and identify findings that may affect how trucking is administered in this province.

1.1 United States

A review of truck use in the United States produced the following results:

Findings

- Truck travel was estimated at approximately 308 billion vehicle-kilometres in 1997. The number of vehicle-kilometres generated by large trucks has increased by almost 40% in less than 10 years.
- The collision rate for large trucks has been estimated at 0.76 collisions per million vehicle-kilometres.
- The widespread use of double-trailers began in 1982 following legislation of the *Surface Transportation Assistance Act.*
- The composition of the U.S. truck fleet includes:
    - single unit truck – 68 percent
    - single unit truck with trailer – 4 percent
    - semi-trailer (primarily 5-axle) – 26 percent
    - double-trailer – 2 percent
    - triple-trailer – less than 0.1 percent
- Long combination vehicles are typical of the trucks in Special Haul Programs. These vehicles, which currently operate primarily in western states, include:
    - Rocky Mountain Doubles – operate in 20 states
    - Turnpike Doubles – operate in 17 states
    - Triple-trailers – operate in 14 states
- The U.S. government has recently completed a comprehensive truck study to review national truck size and weight limits. The study indicates that it is feasible to increase the current limits but it is anticipated that this is unlikely to occur.

Summary of Review - United States

- A recurring theme among truck research papers has been the lack of available data to adequately assess safety. Central to the shortcomings is that existing collision databases have insufficient detail and there has not been enough data to produce a statistically valid assessment.
- There is still considerable debate over the safety of large trucks, despite a comprehensive review of truck size and weight limits by the U.S. Department of Transportation.

- It may be difficult to apply the findings from past studies to other locations because of differing conditions (e.g. operating conditions, roadway type, etc.). For example, a study may indicate turnpike doubles as being safe. However, the study results may be limited because the vehicle's operation was reviewed only on turnpike roadways that are generally designed to a higher standard.

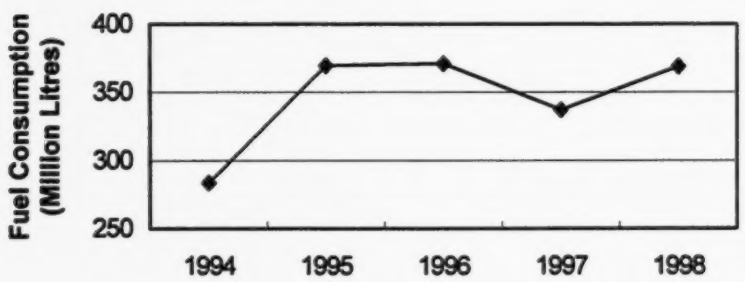
1.2 Canada

A review of truck use in Canada produced the following results:

Findings

- Trucking is the most common means of moving freight in Canada. Approximately 75% of total spending on freight transport each year is on truck transport.
- It is estimated that there are 10,000 commercial trucking companies (i.e. excluding private fleets) and 820,000 commercial trucks currently in Canada.
- There are approximately 46,000 truck collisions recorded in Canada yearly.
- Exhibit 1 presents historical diesel fuel consumption in Canada for private carriers. The increase in diesel fuel consumption can be used to illustrate an increase in truck use.

Exhibit 1
Private Carrier Diesel Fuel Consumption in Canada



Summary of Review - Canada

- The amount of literature available on the safety of over-sized and over-weight trucks operating in Canada is limited.
- The number of vehicle-kilometres travelled by all trucks in this country is unknown. Each province in Canada carries its own records on collisions and estimates for truck vehicle-kilometres. Inconsistencies between databases and truck categories between provinces makes it difficult to develop national truck travel estimates.
- No comparison can be made to the U.S. regarding truck usage or collision rates because of lack of Canada-wide data on truck travel.

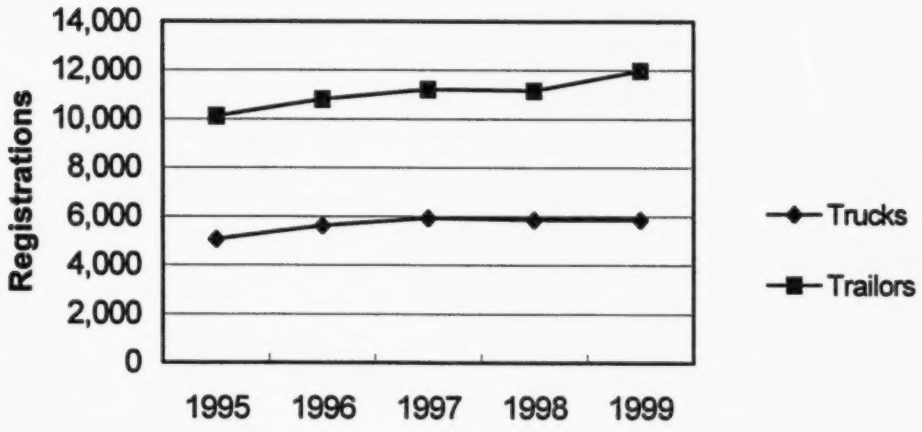
1.3 Saskatchewan

A review of truck use in Saskatchewan produced the following results:

Findings

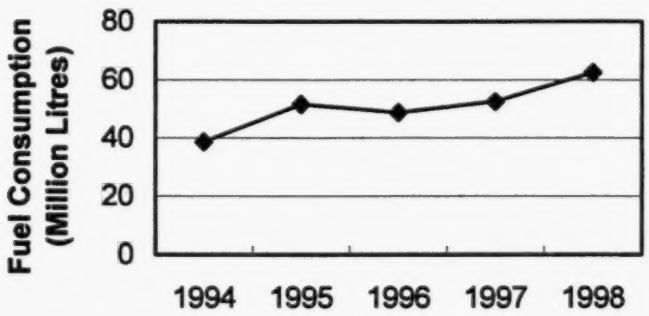
- Trucks, in general, have increased in size within Saskatchewan.
- Saskatchewan is an area of extensive truck use. This is a result of the distance between communities and remoteness of natural resources.
- Trucks accounted for an estimated 1.7 billion vehicle-kilometres of travel in 1999.
- A total of 1,258 truck collisions were reported in Saskatchewan during 1999.
- There are approximately 18,520 trucks currently registered in Saskatchewan. This accounts for 2.6 percent (i.e. 18,520 / 715,530) of all registered vehicles in the province.
- 5,855 of the registered trucks in Saskatchewan are articulated trucks.
- Exhibit 2 indicates the number of articulated truck and trailer registrations in Saskatchewan. The exhibit illustrates that the number of registered articulated trucks has been quite constant between 1995 and 1999. The number of registered truck trailers has progressively increased over the past 5 years.

Exhibit 2
Saskatchewan Articulated-Truck and Trailer Registrations



- Exhibit 3 presents historical diesel fuel consumption in the Prairie Provinces for private carriers. The increase in diesel fuel consumption can be used to illustrate an increase in truck use.

Exhibit 3
Private Carrier Diesel Fuel Consumption in Prairie Provinces



- Saskatchewan contains 2.3 percent of all Canadian trucks (18520 / 820,000) permitted to operate in Canada

- consumption of diesel fuel in the Prairie provinces accounts for 16.5 percent of all consumption in Canada (52 / 375 million litres)

Summary of Review - Saskatchewan

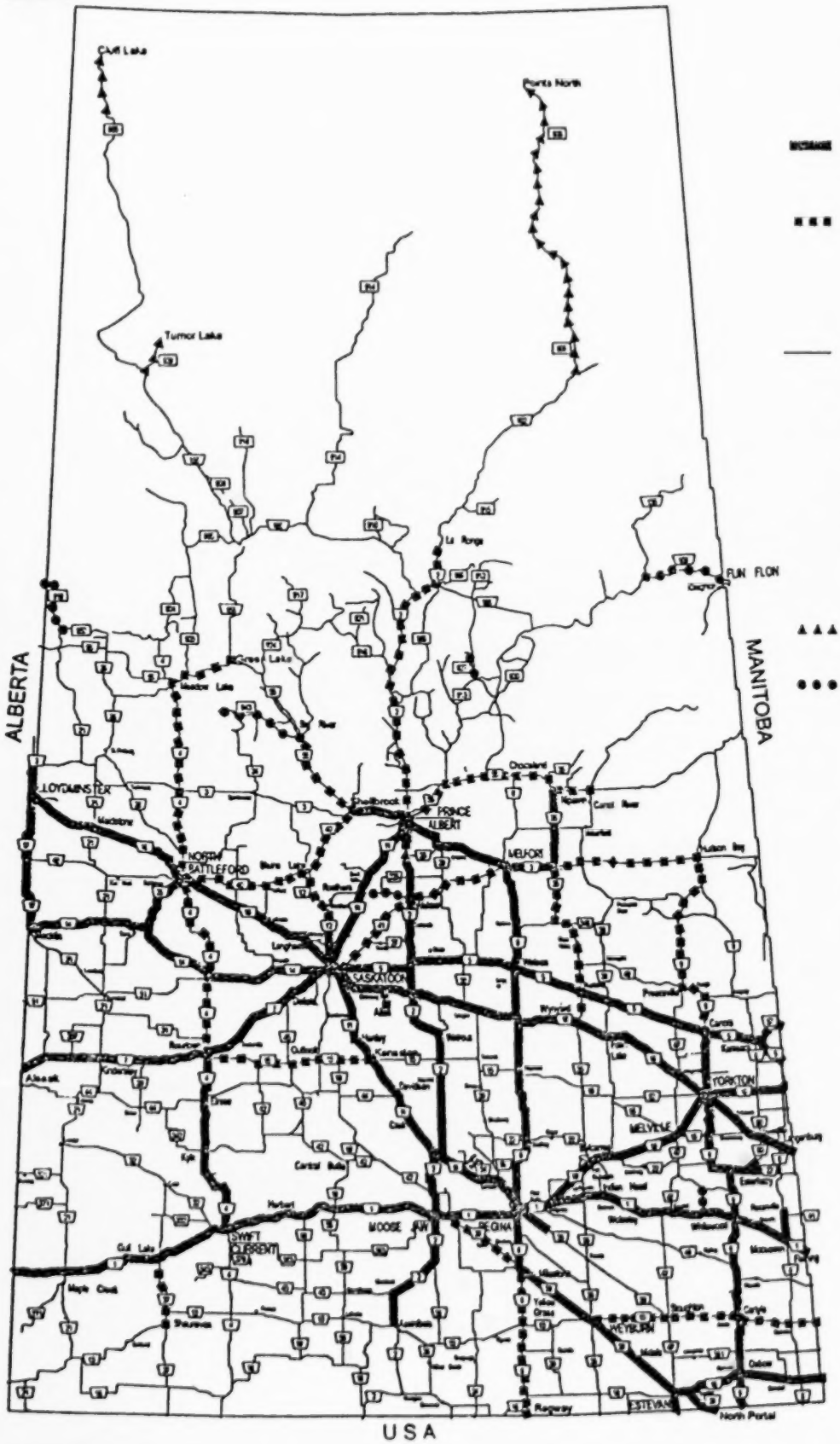
- Previous studies identify the operation of trucks in the province to have generally been safe.

- The lack of provincial travel data used for assessment in these studies has been acknowledged.

APPENDIX C

SASKATCHEWAN WEIGHT LIMIT MAP

Saskatchewan
Highways and
Transportation



Weight Limits

All public highways are classified according to the following weight categories:

Primary Weights:
The primary highways are shown on th map. Most of these are allowed primary weights year round.

A smaller group reverts to secondary weight levels during May and June whe the highways are in their weakest condition.

Secondary and Municipal Weights:
Secondary highways include all provincial highways and provincial road shown on the Official Highway Map oth than those designated as primary.

Municipal highways include public highways other than provincial highway and provincial roads. Generally, this includes all roads maintained by Saskatchewan's rural municipalities including the 600 and 700 series roads which are shown on the Official Highwa Map.

Other:
These highways have bridge limited gross vehicle weights.

These provincial highways are not allowed "winter weights".

Year-round Restricted Weights:
Certain highways have maximum gross weights regardless of their classificatior the vehicle configuration or the time of year. Weight restricted secondary highways are limited to 41 500 kg.

Winter Weight Exceptions:
Winter weights do not apply on the following highways:

Highway No. 106 - junction No. 135 to Manitoba Border;
Highway No. 201 - junction No. 1 to junction No. 247;
Highway No. 312 - Jct. No. 11 to Jct. N 225; and
Provincial Roads Nos. 919, 927 and 94

APPENDIX D

SPECIAL HAUL PROGRAMS

OPERATING REQUIREMENTS

SPECIAL HAUL PROGRAMS OPERATING REQUIREMENTS

Special Haul Programs places additional controls on the operation of permitted trucks beyond those required of the normal fleet, including the following provisions:

- *Designated Routes* - each company participating in the program has designated truck routes. These routes are established with consideration for the truck sizes and weights allowed to operate, pavement/road structure, traffic volume and bridge load capacities. For example, in the EEMV program, Turnpike Doubles and Triples are only allowed to operate on 4-lane divided highways.

- *Vehicle Inspection* - all trucks, whether or not they are involved in Special Haul Programs, must have their power units checked 2 times per year and trailers must be inspected once per year. Prior to a truck being allowed to operate in Special Haul Programs, the truck must be inspected to ensure that it is capable of hauling the proposed loads. Saskatchewan Highways and Transportation can also perform an audit on any vehicle in Special Haul Programs at any time to ensure that it is complying with operational regulations.

- *Driver Training* - beyond possessing a Class 1A license, drivers operating under the Special Haul Programs are subjected to the following restrictions:

    - No driver-related Criminal Code violations in the preceding 36 months
    - No more than 2 moving violations in the preceding 12 months
    - No more than 3 moving violations in the preceding 36 months
    - Medical exam within past 2 years
    - PDIC (Professional Driver Improvement Course) within the past 4 years
    - Minimum of 2 years experience on combination trailer units or 150,000 km on articulated vehicles having gross vehicle weight greater than 20,000 kg

- *Driving Time Restrictions* - trucks in the EEMV program are restricted to operate at certain times depending on the roadway traffic. This measure is intended to reduce the exposure of the trucks to the normal traffic stream at peak traffic periods.

- *Speed Restriction* - vehicles operating in Special Haul Programs are restricted to a 90 km/h speed limit. This slower speed offers the advantage of easier passing for by cars and decreased braking time for the trucks. However, there is some concern over the speed differential caused by having trucks travel slower that the cars.

APPENDIX E

SPECIAL HAUL PROGRAMS

TYPICAL ROUTE MAPS

Typical Bulk Haul Route Map

EEMV Route Map

HOURS of ALLOWABLE EEMV OPERATION

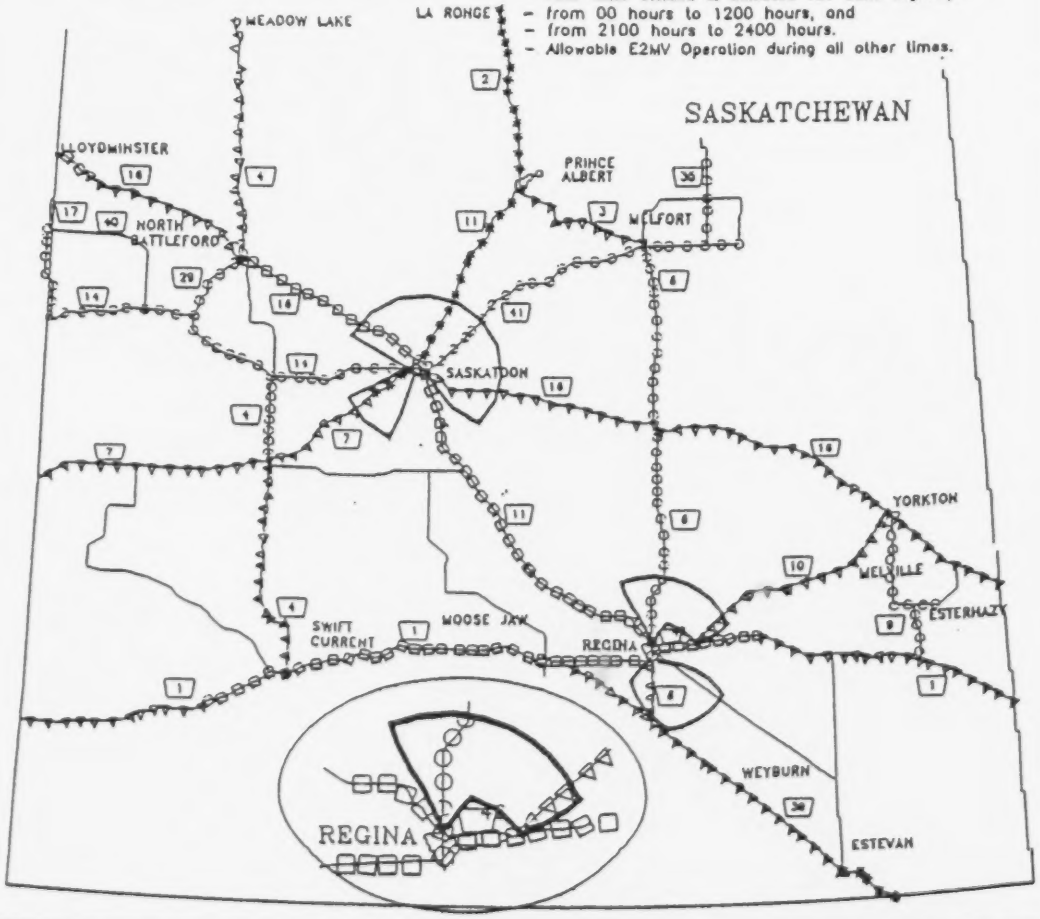
50 km Commuter Zone (Monday to Friday):
on two lane highways from :
- 00 hours to 700 hours,
- 900 hours to 1600 hours
- 1900 hours to 2400 hours.
- Saturdays & Sundays from 00 hours to 2400 hours.

OOOOO Routes with Minor Reduced Hours:
- The day preceding and the concluding day of a Statutory Holiday Weekend and Statutory Holidays that fall on weekdays: from 00 hours to 1100 hours, and from 2100 hours to 2400 hours.
- Allowable E2MV Operation during all other times.

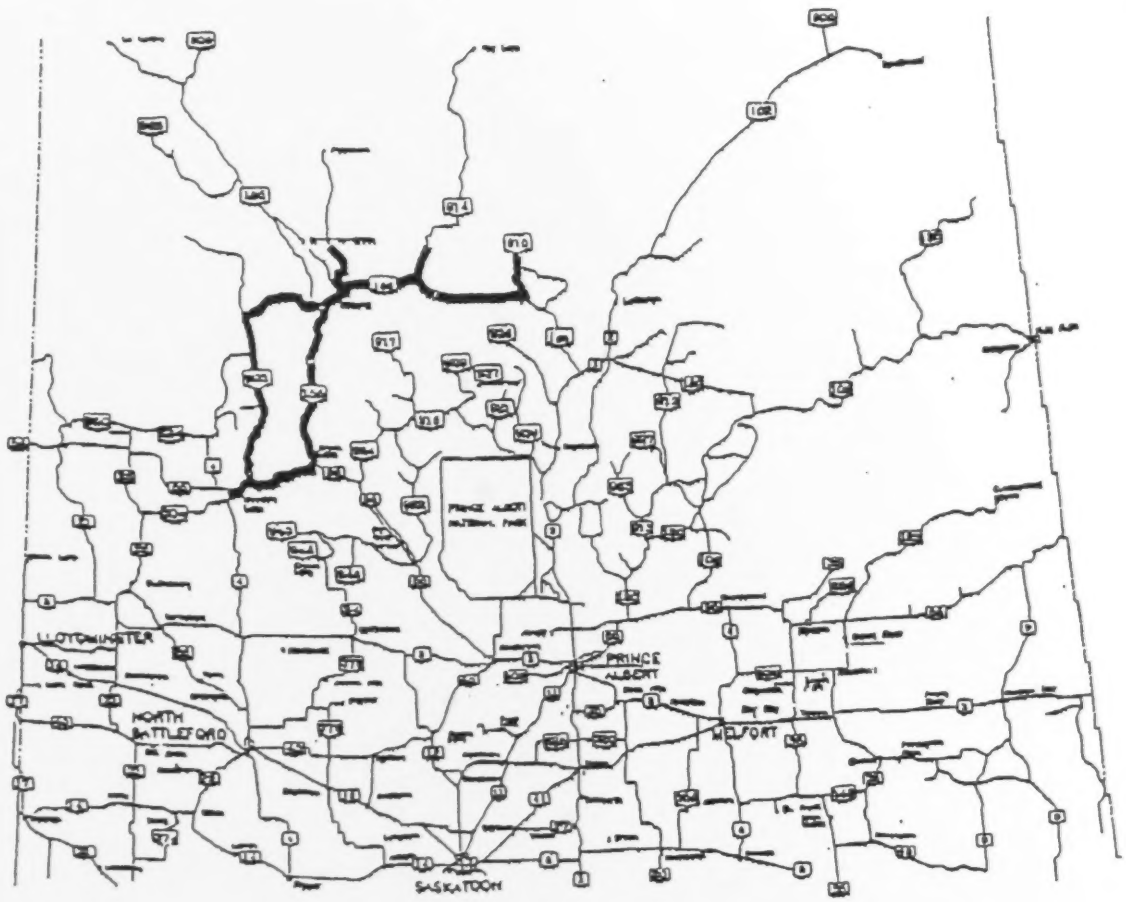
• • • • • Routes with Year Round Reduced Hours:
- Monday to Friday: from 00 hours to 700 hours, and from 2100 hours to 2400 hours.
- Saturdays, Sundays and Statutory Holidays: from 00 hours to 900 hours, and from 2100 hours to 2400 hours.

△△△△△ Routes with Seasonal Reduced Hours:
- From the May Long Weekend to the September Long Weekend: from 00 hours to 900 hours, and from 2100 hours to 2400 hours.
- From the September Long Weekend to the May Long Weekend:
  - Fridays and Sundays: from 00 hours to 1100 hours, and from 2100 hours to 2400 hours.
  - Mondays to Thursdays & Saturdays: from 00 hours to 2400 hours.
  - The day preceding and the concluding day of a Statutory Holiday Weekend and Statutory Holidays that fall on weekdays: from 00 hours to 1100 hours, and from 2100 hours to 2400 hours.

□□□□□ Routes with Statutory Holiday Hours of Restriction:
- Four Lane Divided & Selected Two Lane Highways
- from 00 hours to 1200 hours, and
- from 2100 hours to 2400 hours.
- Allowable E2MV Operation during all other times.



Typical Timber Haul Route Map



Saskatchewan Highways and Transportation

TIMBER TRANSPORTATION AGREEMENT

APPENDIX F

FACTORS AFFECTING THE SIZE OF SPECIAL HAUL PROGRAMS

FACTORS AFFECTING SPECIAL HAUL PROGRAMS SIZE

An important consideration in the public's perception of safety relates to the number of large trucks visible on the roadway. The trucking industry is subject to many factors that can affect the number, types and sizes and weights of trucks in operation. International and national issues currently being examined in the trucking industry that may affect truck operation in Canada, include:

- *roadway condition* – roadway maintenance costs, pavement strength and geometric design may limit the size of trucks and allowable weights in the future
- *co-ordination of differing truck size and weight limits in different jurisdictions* - carriers must consider the different truck size and weight regulations when moving goods across different provincial or state jurisdictions and have a fleet that can accommodate these differences
- *recent international environmental legislation limiting green house gas emissions* - should Canada sign-on to the Kyoto Protocol, mechanisms would have to be implemented to decrease the emission of green house gases. Among the changes may be provisions for truck operation
- *special north-south corridors allowing the movement of trucks* - a joint study is currently evaluating specific trucking corridors to link Canada, United States and Mexico
- *consistency in regulations* - Canada, United States and Mexico have focused efforts to harmonise trucking regulations across North America to improve inter-jurisdictional travel

In addition to these factors affecting the growth and composition of all transport by truck, some of the factors that can directly influence the participation in Special Haul Programs include:

- *time of operating restrictions* - the operation of "just in time" delivery has become more prevalent in the trucking industry. In general this type of delivery utilises smaller trucks than are present in the Special Haul Programs.
- *speed limit* - the 90 km/h speed limit in Special Haul Programs restricts the participation of some companies, particularly those with time-sensitive operations
- *economic base* - the number of companies that would benefit from an increase in truck size is limited
- *route restrictions* - companies intending to transport goods across provinces or states must follow the regulations of each provincial or state jurisdiction

While outcomes of these issues can influence the overall national composition of a truck fleet, it is anticipated that there will be no significant changes to current truck size and weight limits. The current limits have been based upon the existing truck fleet and road infrastructure.

APPENDIX G

TRUCK PERFORMANCE CHARACTERISTICS OVERVIEW

Truck Performance Characteristics

Traditionally truck size and weight limits have been established based on the load-bearing capability of the highways and bridges being travelled on. Size and weight limits were imposed with the intention of providing protection to the road infrastructure so it could serve a transportation function for a reasonable period of investment. In recent years, safety considerations have had increasing influence on allowable truck size and weight limits. There is recognition that a truck's size and weight are related to its performance in terms of the its control and stability characteristics. Truck performance in turn affects the safe operation of a truck.

Specific truck performance characteristics that affect safety include:

- *Static Rollover* - due to their higher centre of gravity, trucks are more susceptible to overturning during steady sweeping turns than are passenger cars. Various design measures can be employed to decrease a truck's susceptibility to turnover including decreasing the centre of gravity and widening a truck's track width. Other secondary factors affecting the static rollover include suspension properties and, in the case of combination vehicles, trailer coupling device properties.
- *Braking* - a truck's ability to stop in a short distance or its stability during braking is primarily dependant upon the brake's size, configuration and maintenance and tire properties. Larger trucks, when equipped according to current brake standards are expected to perform adequately. However, increased axles require greater maintenance attention due to the increased opportunity for uneven braking.
- *Rearward Amplification* - rearward amplification refers to the potential for the rear trailer of a combination truck to "whip" in response to rapid steering that can occur during a sudden lane change or an obstacle avoidance manoeuvre. Rearward amplification can be partially mitigated through increased trailer lengths, fewer articulation points and use of C-dollies.
- *High-Speed Offtracking* - this occurs when combination vehicles turn at a high speed resulting in the wheels of the rearmost axle tracking outside the path of the frontmost axle. As with rearward amplification, high-speed offtracking can be partially mitigated through increased trailer lengths, fewer articulation points and use of C-dollies. High-speed offtracking has not been linked to any appreciable number of truck collisions.
- *Low-Speed Offtracking* - this occurs when a combination vehicle makes a low-speed turn at an intersection. During the turn, the wheels of the rearmost axle follow a path to the inside of the path of the front-most axle. The potential effect of this performance characteristic is the encroachment of a truck into adjacent traffic lanes or the sideswiping of roadside objects.
- *Load Transfer Ratio* - when a truck executes a lane change or performs an evasive manoeuvre, forces will load one wheel on an axle more than the other. The effect of shifting the axle load to one side of the axle can cause a rollover.